SEQUENCE LISTING

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<120> Compositions and Methods of Using Hexokinase V

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<140> US 10/805,075
<141> 2004-03-19

<150> US 60/456,650
<151> 2003-03-20

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<170> PatentIn Ver. 2.1

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Asp Asp Thr Leu Leu Asp Ile Met Arg Arg Phe Arg Ala Glu Met Glu
         35                  40                  45

Lys Gly Leu Ala Lys Asp Thr Asn Pro Thr Ala Ala Val Lys Met Leu
     50                  55                  60

Pro Thr Phe Val Arg Ala Ile Pro Asp Gly Ser Glu Asn Gly Glu Phe
 65                  70                  75                  80

Leu Ser Leu Asp Leu Gly Gly Ser Lys Phe Arg Val Leu Lys Val Gln
                 85                  90                  95

Val Ala Glu Glu Gly Lys Arg His Val Gln Met Glu Ser Gln Phe Tyr
            100                 105                 110

Pro Thr Pro Asn Glu Ile Ile Arg Gly Asn Gly Ile Glu Leu Phe Glu
        115                 120                 125

Tyr Val Ala Asp Cys Leu Ala Asp Phe Met Lys Thr Lys Asp Leu Lys
    130                 135                 140

His Lys Lys Leu Pro Leu Gly Leu Thr Phe Ser Phe Pro Cys Arg Gln
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Thr Lys Leu Glu Glu Gly Val Leu Leu Ser Trp Thr Lys Lys Phe Lys
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Asp Thr Val Gly Thr Met Met Thr Cys Ala Tyr Asp Asp Pro Tyr Cys
    210                 215                 220

Glu Val Gly Val Ile Ile Gly Thr Gly Thr Asn Ala Cys Tyr Met Glu
225                 230                 235                 240

Asp Met Ser Asn Ile Asp Leu Val Glu Gly Asp Glu Gly Arg Met Cys
                245                 250                 255

Ile Asn Thr Glu Trp Gly Ala Phe Gly Asp Asp Gly Ala Leu Glu Asp
            260                 265                 270

Ile Arg Thr Glu Phe Asp Arg Glu Leu Asp Leu Gly Ser Leu Asn Pro
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Gly Lys Gln Leu Phe Glu Lys Met Ile Ser Gly Leu Tyr Leu Gly Glu
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Leu Val Arg Leu Ile Leu Leu Lys Met Ala Lys Ala Gly Leu Leu Phe
305                 310                 315                 320

Gly Gly Glu Lys Ser Ser Ala Leu His Thr Lys Gly Lys Ile Glu Thr
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Arg His Val Ala Ala Met Glu Lys Tyr Lys Glu Gly Leu Ala Asn Thr
            340                 345                 350

Arg Glu Ile Leu Val Asp Leu Gly Leu Glu Pro Ser Glu Ala Asp Cys
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Ile Ala Val Gln His Val Cys Thr Ile Val Ser Phe Arg Ser Ala Asn
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Leu Cys Ala Ala Ala Leu Ala Ala Ile Leu Thr Arg Leu Arg Glu Asn
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Lys Lys Val Glu Arg Leu Arg Thr Thr Val Gly Met Asp Gly Thr Leu
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Tyr Lys Ile His Pro Gln Tyr Pro Lys Arg Leu His Lys Val Val Arg
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Lys Leu Val Pro Ser Cys Asp Val Arg Phe Leu Leu Ser Glu Ser Gly
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Ser Thr Lys Gly Ala Ala Met Val Thr Ala Val Ala Ser Arg Val Gln
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Ala Gln Arg Lys Gln Ile Asp Arg Val Leu Ala Leu Phe Gln Leu Thr
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Arg Glu Gln Leu Val Asp Val Gln Ala Lys Met Arg Ala Glu Leu Glu
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Ser Ile Asp Lys Gly Thr Leu Ile Gly Trp Thr Lys Gly Phe Lys Ala
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Thr Asp Cys Glu Gly Glu Asp Val Val Asp Met Leu Arg Glu Ala Ile
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Arg Ile Leu Gln Gln Leu Gly Leu Asp Ser Thr Cys Glu Asp Ser Ile
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Cys Gly Ala Gly Leu Ala Ala Ile Val Glu Lys Arg Arg Glu Asp Gln
        835                 840                 845

Gly Leu Glu His Leu Arg Ile Thr Val Gly Val Asp Gly Thr Leu Tyr
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Lys Leu His Pro His Phe Ser Arg Ile Leu Gln Glu Thr Val Lys Glu
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Leu Ala Pro Arg Cys Asp Val Thr Phe Met Leu Ser Glu Asp Gly Ser
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Ala Gln Lys Glu Asn
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Asp Asp Thr Leu Leu Asp Ile Met Arg Arg Phe Arg Ala Glu Met Glu
         35                  40                  45

Lys Gly Leu Ala Lys Asp Thr Asn Pro Thr Ala Ala Val Lys Met Leu
     50                  55                  60

Pro Thr Phe Val Arg Ala Ile Pro Asp Gly Ser Glu Asn Gly Glu Phe
 65                  70                  75                  80
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Leu Ser Leu Asp Leu Gly Gly Ser Lys Phe Arg Val Leu Lys Val Gln
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Val Ala Glu Glu Gly Lys Arg His Val Gln Met Glu Ser Gln Phe Tyr
            100                 105                 110

Pro Thr Pro Asn Glu Ile Ile Arg Gly Asn Gly Thr Glu Leu Phe Glu
        115                 120                 125

Tyr Val Ala Asp Cys Leu Ala Asp Phe Met Lys Thr Lys Asp Leu Lys
    130                 135                 140

His Lys Lys Leu Pro Leu Gly Leu Thr Phe Ser Phe Pro Cys Arg Gln
145                 150                 155                 160

Thr Lys Leu Glu Glu Gly Val Leu Leu Ser Trp Thr Lys Lys Phe Lys
                165                 170                 175

Ala Arg Gly Val Gln Asp Thr Asp Val Val Ser Arg Leu Thr Lys Ala
            180                 185                 190

Met Arg Arg His Lys Asp Met Asp Val Asp Ile Leu Ala Leu Val Asn
        195                 200                 205

Asp Thr Val Gly Thr Met Met Thr Cys Ala Tyr Asp Asp Pro Tyr Cys
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Glu Val Gly Val Ile Ile Gly Thr Gly Thr Asn Ala Cys Tyr Met Glu
225                 230                 235                 240

Asp Met Ser Asn Ile Asp Leu Val Glu Gly Asp Glu Gly Arg Met Cys
                245                 250                 255

Ile Asn Thr Glu Trp Gly Ala Phe Gly Asp Asp Gly Ala Leu Glu Asp
            260                 265                 270

Ile Arg Thr Glu Phe Asp Arg Glu Leu Asp Leu Gly Ser Leu Asn Pro
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Gly Lys Gln Leu Phe Glu Lys Met Ile Ser Gly Leu Tyr Leu Gly Glu
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Leu Val Arg Leu Ile Leu Leu Lys Met Ala Lys Ala Gly Leu Leu Phe
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Gly Gly Glu Lys Ser Ser Ala Leu His Thr Lys Gly Lys Ile Glu Thr
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Arg His Val Ala Ala Met Glu Lys Tyr Lys Glu Gly Leu Ala Asn Thr
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Arg Glu Ile Leu Val Asp Leu Gly Leu Glu Pro Ser Glu Ala Asp Cys
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Ile Ala Val Gln His Val Cys Thr Ile Val Ser Phe Arg Ser Ala Asn
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Leu Cys Ala Ala Ala Leu Ala Ala Ile Leu Thr Arg Leu Arg Glu Asn
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Lys Lys Val Glu Arg Leu Arg Thr Thr Val Gly Met Asp Gly Thr Leu
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Tyr Lys Ile His Pro Gln Tyr Pro Lys Arg Leu His Lys Val Val Arg
            420                 425                 430

Lys Leu Val Pro Ser Cys Asp Val Arg Phe Leu Leu Ser Glu Ser Gly
        435                 440                 445

Ser Thr Lys Gly Ala Ala Met Val Thr Ala Val Ala Ser Arg Val Gln
    450                 455                 460

Ala Gln Arg Lys Gln Ile Asp Arg Val Leu Ala Leu Phe Gln Leu Thr
465                 470                 475                 480

Arg Glu Gln Leu Val Asp Val Gln Ala Lys Met Arg Ala Glu Leu Glu
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Tyr Gly Leu Lys Lys Lys Ser His Gly Leu Ala Thr Val Arg Met Leu
            500                 505                 510

Pro Thr Tyr Val Cys Gly Leu Pro Asp Gly Thr Glu Lys Gly Lys Phe
        515                 520                 525

Leu Ala Leu Asp Leu Gly Gly Thr Asn Phe Arg Val Leu Leu Val Lys
    530                 535                 540

Ile Arg Ser Gly Arg Arg Ser Val Arg Met Tyr Asn Lys Ile Phe Ala
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Ile Pro Leu Glu Ile Met Gln Gly Thr Gly Glu Glu Leu Phe Asp His
                565                 570                 575

Ile Val Gln Cys Ile Ala Asp Phe Leu Asp Tyr Met Gly Leu Lys Gly
            580                 585                 590

Ala Ser Leu Pro Leu Gly Phe Thr Phe Ser Phe Pro Cys Arg Gln Met
        595                 600                 605

Ser Ile Asp Lys Gly Thr Leu Ile Gly Trp Thr Lys Gly Phe Lys Ala
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Thr Asp Cys Glu Gly Glu Asp Val Val Asp Met Leu Arg Glu Ala Ile
625                 630                 635                 640

Lys Arg Arg Asn Glu Phe Asp Leu Asp Ile Val Ala Val Val Asn Asp
                645                 650                 655

Thr Val Gly Thr Met Met Thr Cys Gly Tyr Glu Asp Pro Asn Cys Glu
            660                 665                 670

Ile Gly Leu Ile Ala Gly Thr Gly Ser Asn Met Cys Tyr Met Glu Asp
        675                 680                 685

Met Arg Asn Ile Glu Met Val Glu Gly Gly Glu Gly Lys Met Cys Ile
    690                 695                 700

Asn Thr Glu Trp Gly Gly Phe Gly Asp Asn Gly Cys Ile Asp Asp Ile
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Val Arg Gln Ile Leu Ile Asp Leu Thr Lys Gln Gly Leu Leu Phe Arg
        755                 760                 765

Gly Gln Ile Ser Glu Arg Leu Arg Thr Arg Gly Ile Phe Glu Thr Lys
    770                 775                 780

Phe Leu Ser Gln Ile Glu Ser Asp Arg Leu Ala Leu Leu Gln Val Arg
785                 790                 795                 800

Arg Ile Leu Gln Gln Leu Gly Leu Asp Ser Thr Cys Glu Asp Ser Ile
                805                 810                 815

Val Val Lys Glu Val Cys Gly Ala Val Ser Arg Arg Ala Ala Gln Leu
            820                 825                 830

Cys Gly Ala Gly Leu Ala Ala Ile Val Glu Lys Arg Arg Glu Asp Gln
        835                 840                 845

Gly Leu Glu His Leu Arg Ile Thr Val Gly Val Asp Gly Thr Leu Tyr
    850                 855                 860

Lys Leu His Pro His Phe Ser Arg Ile Leu Gln Glu Thr Val Lys Glu
865                 870                 875                 880

Leu Ala Pro Arg Cys Asp Val Thr Phe Met Leu Ser Glu Asp Gly Ser
                885                 890                 895

Gly Lys Gly Ala Ala Leu Ile Thr Ala Val Ala Lys Arg Leu Gln Gln
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Ala Gln Lys Glu Asn
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Asp Gln Val Lys Lys Ile Asp Lys Tyr Leu Tyr Ala Met Arg Leu Ser
            20                  25                  30

Asp Glu Thr Leu Ile Asp Ile Met Thr Arg Phe Arg Lys Glu Met Lys
        35                  40                  45

Asn Gly Leu Ser Arg Asp Phe Asn Pro Thr Ala Thr Val Lys Met Leu
    50                  55                  60
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Pro Thr Phe Val Arg Ser Ile Pro Asp Gly Ser Glu Lys Gly Asp Phe
 65                  70                  75                  80

Ile Ala Leu Asp Leu Gly Gly Ser Ser Phe Arg Ile Leu Arg Val Gln
                85                  90                  95

Val Asn His Glu Lys Asn Gln Asn Val His Met Glu Ser Glu Val Tyr
            100                 105                 110

Asp Thr Pro Glu Asn Ile Val His Gly Ser Gly Ser Gln Leu Phe Asp
        115                 120                 125

His Val Ala Glu Cys Leu Gly Asp Phe Met Glu Lys Arg Lys Ile Lys
    130                 135                 140

Asp Lys Lys Leu Pro Val Gly Phe Thr Phe Ser Phe Pro Cys Gln Gln
145                 150                 155                 160

Ser Lys Ile Asp Glu Ala Ile Leu Ile Thr Trp Thr Lys Arg Phe Lys
                165                 170                 175

Ala Ser Gly Val Glu Gly Ala Asp Val Val Lys Leu Leu Asn Lys Ala
            180                 185                 190

Ile Lys Lys Arg Gly Asp Tyr Asp Ala Asn Ile Val Ala Val Val Asn
        195                 200                 205

Asp Thr Val Gly Thr Met Met Thr Cys Gly Tyr Asp Asp Gln His Cys
    210                 215                 220

Glu Val Gly Leu Ile Ile Gly Thr Gly Thr Asn Ala Cys Tyr Met Glu
225                 230                 235                 240

Glu Leu Arg His Ile Asp Leu Val Glu Gly Asp Glu Gly Arg Met Cys
                245                 250                 255

Ile Asn Thr Glu Trp Gly Ala Phe Gly Asp Asp Gly Ser Leu Glu Asp
            260                 265                 270

Ile Arg Thr Glu Phe Asp Arg Glu Ile Asp Arg Gly Ser Leu Asn Pro
        275                 280                 285

Gly Lys Gln Leu Phe Glu Lys Met Val Ser Gly Met Tyr Leu Gly Glu
    290                 295                 300

Leu Val Arg Leu Ile Leu Val Lys Met Ala Lys Glu Gly Leu Leu Phe
305                 310                 315                 320

Glu Gly Arg Ile Thr Pro Glu Leu Leu Thr Arg Gly Lys Phe Asn Thr
                325                 330                 335

Ser Asp Val Ser Ala Ile Glu Lys Asn Lys Glu Gly Leu His Asn Ala
            340                 345                 350

Lys Glu Ile Leu Thr Arg Leu Gly Val Glu Pro Ser Asp Asp Asp Cys
        355                 360                 365

Val Ser Val Gln His Val Cys Thr Ile Val Ser Phe Arg Ser Ala Asn
    370                 375                 380
```

```
Leu Val Ala Ala Thr Leu Gly Ala Ile Leu Asn Arg Leu Arg Asp Asn
385                 390                 395                 400

Lys Gly Thr Pro Arg Leu Arg Thr Thr Val Gly Val Asp Gly Ser Leu
                405                 410                 415

Tyr Lys Thr His Pro Gln Tyr Ser Arg Arg Phe His Lys Thr Leu Arg
            420                 425                 430

Arg Leu Val Pro Asp Ser Asp Val Arg Phe Leu Leu Ser Glu Ser Gly
        435                 440                 445

Ser Gly Lys Gly Ala Ala Met Val Thr Ala Val Ala Tyr Arg Leu Ala
    450                 455                 460

Glu Gln His Arg Gln Ile Glu Glu Thr Leu Ala His Phe His Leu Thr
465                 470                 475                 480

Lys Asp Met Leu Leu Glu Val Lys Lys Arg Met Arg Ala Glu Met Glu
                485                 490                 495

Leu Gly Leu Arg Lys Gln Thr His Asn Asn Ala Val Val Lys Met Leu
            500                 505                 510

Pro Ser Phe Val Arg Arg Thr Pro Asp Gly Thr Glu Asn Gly Asp Phe
        515                 520                 525

Leu Ala Leu Asp Leu Gly Gly Thr Asn Phe Arg Val Leu Leu Val Lys
    530                 535                 540

Ile Arg Ser Gly Lys Lys Arg Thr Val Glu Met His Asn Lys Ile Tyr
545                 550                 555                 560

Ala Ile Pro Ile Glu Ile Met Gln Gly Thr Gly Glu Glu Leu Phe Asp
                565                 570                 575

His Ile Val Ser Cys Ile Ser Asp Phe Leu Asp Tyr Met Gly Ile Lys
            580                 585                 590

Gly Pro Arg Met Pro Leu Gly Phe Thr Phe Ser Phe Pro Cys Gln Gln
        595                 600                 605

Thr Ser Leu Asp Ala Gly Ile Leu Ile Thr Trp Thr Lys Gly Phe Lys
    610                 615                 620

Ala Thr Asp Cys Val Gly His Asp Val Val Thr Leu Leu Arg Asp Ala
625                 630                 635                 640

Ile Lys Arg Arg Glu Glu Phe Asp Leu Asp Val Val Ala Val Val Asn
                645                 650                 655

Asp Thr Val Gly Thr Met Met Thr Cys Ala Tyr Glu Glu Pro Thr Cys
            660                 665                 670

Glu Val Gly Leu Ile Val Gly Thr Gly Ser Asn Ala Cys Tyr Met Glu
        675                 680                 685

Glu Met Lys Asn Val Glu Met Val Glu Gly Asp Gln Gly Gln Met Cys
    690                 695                 700
```

```
Ile Asn Met Glu Trp Gly Ala Phe Gly Asp Asn Gly Cys Leu Asp Asp
705                 710                 715                 720

Ile Arg Thr His Tyr Asp Arg Leu Val Asn Glu Tyr Ser Leu Asn Ala
                725                 730                 735

Gly Lys Gln Arg Tyr Glu Lys Met Ile Ser Gly Met Tyr Leu Gly Glu
            740                 745                 750

Ile Val Arg Asn Ile Leu Ile Asp Phe Thr Lys Lys Gly Phe Leu Phe
        755                 760                 765

Arg Gly Gln Ile Ser Glu Thr Met Lys Thr Arg Gly Ile Phe Glu Thr
    770                 775                 780

Lys Phe Leu Ser Gln Ile Glu Ser Asp Arg Leu Ala Leu Leu Gln Val
785                 790                 795                 800

Arg Ala Ile Leu Gln Gln Leu Gly Leu Asn Ser Thr Cys Asp Asp Ser
                805                 810                 815

Ile Leu Val Lys Thr Val Cys Gly Val Val Ser Arg Arg Ala Ala Gln
            820                 825                 830

Leu Cys Gly Ala Gly Met Ala Ala Val Val Asp Lys Ile Arg Glu Asn
        835                 840                 845

Arg Gly Leu Asp Arg Leu Asn Val Thr Val Gly Val Asp Gly Thr Leu
    850                 855                 860

Tyr Lys Leu His Pro His Phe Ser Arg Ile Met His Gln Thr Val Lys
865                 870                 875                 880

Glu Leu Ser Pro Lys Cys Asn Val Ser Phe Leu Leu Ser Glu Asp Gly
                885                 890                 895

Ser Gly Lys Gly Ala Ala Leu Ile Thr Ala Val Gly Val Arg Leu Arg
            900                 905                 910

Thr Glu Ala Ser Ser
        915
```

<210> 6
<211> 917
<212> PRT
<213> Homo sapiens

<220>
<223> human hexokinase II (HK2)

<400> 6

```
Met Ile Ala Ser His Leu Leu Ala Tyr Phe Phe Thr Glu Leu Asn His
  1               5                  10                  15

Asp Gln Val Gln Lys Val Asp Gln Tyr Leu Tyr His Met Arg Leu Ser
            20                  25                  30

Asp Glu Thr Leu Leu Glu Ile Ser Lys Arg Phe Arg Lys Glu Met Glu
        35                  40                  45
```

```
Lys Gly Leu Gly Ala Thr Thr His Pro Thr Ala Ala Val Lys Met Leu
     50                  55                  60

Pro Thr Phe Val Arg Ser Thr Pro Asp Gly Thr Glu His Gly Glu Phe
 65                  70                  75                  80

Leu Ala Leu Asp Leu Gly Gly Thr Asn Phe Arg Val Leu Trp Val Lys
                85                  90                  95

Val Thr Asp Asn Gly Leu Gln Lys Val Glu Met Glu Asn Gln Ile Tyr
            100                 105                 110

Ala Ile Pro Glu Asp Ile Met Arg Gly Ser Gly Thr Gln Leu Phe Asp
        115                 120                 125

His Ile Ala Glu Cys Leu Ala Asn Phe Met Asp Lys Leu Gln Ile Lys
    130                 135                 140

Asp Lys Lys Leu Pro Leu Gly Phe Thr Phe Ser Phe Pro Cys His Gln
145                 150                 155                 160

Thr Lys Leu Asp Glu Ser Phe Leu Val Ser Trp Thr Lys Gly Phe Lys
                165                 170                 175

Ser Ser Gly Val Glu Gly Arg Asp Val Val Ala Leu Ile Arg Lys Ala
            180                 185                 190

Ile Gln Arg Arg Gly Asp Phe Asp Ile Asp Ile Val Ala Val Val Asn
        195                 200                 205

Asp Thr Val Gly Thr Met Met Thr Cys Gly Tyr Asp Asp His Asn Cys
    210                 215                 220

Glu Ile Gly Leu Ile Val Gly Thr Gly Ser Asn Ala Cys Tyr Met Glu
225                 230                 235                 240

Glu Met Arg His Ile Asp Met Val Glu Gly Asp Glu Gly Arg Met Cys
                245                 250                 255

Ile Asn Met Glu Trp Gly Ala Phe Gly Asp Asp Gly Ser Leu Asn Asp
            260                 265                 270

Ile Arg Thr Glu Phe Asp Gln Glu Ile Asp Met Gly Ser Leu Asn Pro
        275                 280                 285

Gly Lys Gln Leu Phe Glu Lys Met Ile Ser Gly Met Tyr Met Gly Glu
    290                 295                 300

Leu Val Arg Leu Ile Leu Val Lys Met Ala Lys Glu Glu Leu Leu Phe
305                 310                 315                 320

Gly Gly Lys Leu Ser Pro Glu Leu Leu Asn Thr Gly Arg Phe Glu Thr
                325                 330                 335

Lys Asp Ile Ser Asp Ile Glu Gly Glu Lys Asp Gly Ile Arg Lys Ala
            340                 345                 350

Arg Glu Val Leu Met Arg Leu Gly Leu Asp Pro Thr Gln Glu Asp Cys
        355                 360                 365
```

```
Val Ala Thr His Arg Ile Cys Gln Ile Val Ser Thr Arg Ser Ala Ser
    370                 375                 380

Leu Cys Ala Ala Thr Leu Ala Ala Val Leu Gln Arg Ile Lys Glu Asn
385                 390                 395                 400

Lys Gly Glu Glu Arg Leu Arg Ser Thr Ile Gly Val Asp Gly Ser Val
                405                 410                 415

Tyr Lys Lys His Pro His Phe Ala Lys Arg Leu His Lys Thr Val Arg
            420                 425                 430

Arg Leu Val Pro Gly Cys Asp Val Arg Phe Leu Arg Ser Glu Asp Gly
        435                 440                 445

Ser Gly Lys Gly Ala Ala Met Val Thr Ala Val Ala Tyr Arg Leu Ala
    450                 455                 460

Asp Gln His Arg Ala Arg Gln Lys Thr Leu Glu His Leu Gln Leu Ser
465                 470                 475                 480

His Asp Gln Leu Leu Glu Val Lys Arg Arg Met Lys Val Glu Met Glu
                485                 490                 495

Arg Gly Leu Ser Lys Glu Thr His Ala Ser Ala Pro Val Lys Met Leu
            500                 505                 510

Pro Thr Tyr Val Cys Ala Thr Pro Asp Gly Thr Glu Lys Gly Asp Phe
        515                 520                 525

Leu Ala Leu Asp Leu Gly Gly Thr Asn Phe Arg Val Leu Leu Val Arg
    530                 535                 540

Val Arg Asn Gly Lys Trp Gly Gly Val Glu Met His Asn Lys Ile Tyr
545                 550                 555                 560

Ala Ile Pro Gln Glu Val Met His Gly Thr Gly Asp Glu Leu Phe Asp
                565                 570                 575

His Ile Val Gln Cys Ile Ala Asp Phe Leu Glu Tyr Met Gly Met Lys
            580                 585                 590

Gly Val Ser Leu Pro Leu Gly Phe Thr Phe Ser Phe Pro Cys Gln Gln
        595                 600                 605

Asn Ser Leu Asp Glu Ser Ile Leu Leu Lys Trp Thr Lys Gly Phe Lys
    610                 615                 620

Ala Ser Gly Cys Glu Gly Glu Asp Val Val Thr Leu Leu Lys Glu Ala
625                 630                 635                 640

Ile His Arg Arg Glu Glu Phe Asp Leu Asp Val Val Ala Val Val Asn
                645                 650                 655

Asp Thr Val Gly Thr Met Met Thr Cys Gly Phe Glu Asp Pro His Cys
            660                 665                 670

Glu Val Gly Leu Ile Val Gly Thr Gly Ser Asn Ala Cys Tyr Met Glu
        675                 680                 685
```

```
Glu Met Arg Asn Val Glu Leu Val Glu Gly Glu Glu Gly Arg Met Cys
    690                 695                 700

Val Asn Met Glu Trp Gly Ala Phe Gly Asp Asn Gly Cys Leu Asp Asp
705                 710                 715                 720

Phe Arg Thr Glu Phe Asp Val Ala Val Asp Glu Leu Ser Leu Asn Pro
                725                 730                 735

Gly Lys Gln Arg Phe Glu Lys Met Ile Ser Gly Met Tyr Leu Gly Glu
            740                 745                 750

Ile Val Arg Asn Ile Leu Ile Asp Phe Thr Lys Arg Gly Leu Leu Phe
        755                 760                 765

Arg Gly Arg Ile Ser Glu Arg Leu Lys Thr Arg Gly Ile Phe Glu Thr
    770                 775                 780

Lys Phe Leu Ser Gln Ile Glu Ser Asp Cys Leu Ala Leu Leu Gln Val
785                 790                 795                 800

Arg Ala Ile Leu Gln His Leu Gly Leu Glu Ser Thr Cys Asp Asp Ser
                805                 810                 815

Ile Ile Val Lys Glu Val Cys Thr Val Val Ala Arg Arg Ala Ala Gln
            820                 825                 830

Leu Cys Gly Ala Gly Met Ala Ala Val Val Asp Arg Ile Arg Glu Asn
        835                 840                 845

Arg Gly Leu Asp Ala Leu Lys Val Thr Val Gly Val Asp Gly Thr Leu
    850                 855                 860

Tyr Lys Leu His Pro His Phe Ala Lys Val Met His Glu Thr Val Lys
865                 870                 875                 880

Asp Leu Ala Pro Lys Cys Asp Val Ser Phe Leu Gln Ser Glu Asp Gly
                885                 890                 895

Ser Gly Lys Gly Ala Ala Leu Ile Thr Ala Val Ala Cys Arg Ile Arg
            900                 905                 910

Glu Ala Gly Gln Arg
        915


<210> 7
<211> 923
<212> PRT
<213> Homo sapiens

<220>
<223> human hexokinase III (HK3)

<400> 7
Met Asp Ser Ile Gly Ser Ser Gly Leu Arg Gln Gly Glu Glu Thr Leu
  1               5                  10                  15

Ser Cys Ser Glu Glu Gly Leu Pro Gly Pro Ser Asp Ser Ser Glu Leu
             20                  25                  30
```

```
Val Gln Glu Cys Leu Gln Gln Phe Lys Val Thr Arg Ala Gln Leu Gln
         35                  40                  45

Gln Ile Gln Ala Ser Leu Leu Gly Ser Met Glu Gln Ala Leu Arg Gly
     50                  55                  60

Gln Ala Ser Pro Ala Pro Ala Val Arg Met Leu Pro Thr Tyr Val Gly
 65                  70                  75                  80

Ser Thr Pro His Gly Thr Glu Gln Gly Asp Phe Val Val Leu Glu Leu
                85                  90                  95

Gly Ala Thr Gly Ala Ser Leu Arg Val Leu Trp Val Thr Leu Thr Gly
            100                 105                 110

Ile Glu Gly His Arg Val Glu Pro Arg Ser Gln Glu Phe Val Ile Pro
        115                 120                 125

Gln Glu Val Met Leu Gly Ala Gly Gln Gln Leu Phe Asp Phe Ala Ala
    130                 135                 140

His Cys Leu Ser Glu Phe Leu Asp Ala Gln Pro Val Asn Lys Gln Gly
145                 150                 155                 160

Leu Gln Leu Gly Phe Ser Phe Ser Phe Pro Cys His Gln Thr Gly Leu
                165                 170                 175

Asp Arg Ser Thr Leu Ile Ser Trp Thr Lys Gly Phe Arg Cys Ser Gly
            180                 185                 190

Val Glu Gly Gln Asp Val Val Gln Leu Leu Arg Asp Ala Ile Arg Arg
        195                 200                 205

Gln Gly Ala Tyr Asn Ile Asp Val Val Ala Val Val Asn Asp Thr Val
    210                 215                 220

Gly Thr Met Met Gly Cys Glu Pro Gly Val Arg Pro Cys Glu Val Gly
225                 230                 235                 240

Leu Val Val Asp Thr Gly Thr Asn Ala Cys Tyr Met Glu Glu Ala Arg
                245                 250                 255

His Val Ala Val Leu Asp Glu Asp Arg Gly Arg Val Cys Val Ser Val
            260                 265                 270

Glu Trp Gly Ser Leu Ser Asp Asp Gly Ala Leu Gly Pro Val Leu Thr
        275                 280                 285

Thr Phe Asp His Thr Leu Asp His Glu Ser Leu Asn Pro Gly Ala Gln
    290                 295                 300

Arg Phe Glu Lys Met Ile Gly Gly Leu Tyr Leu Gly Glu Leu Val Arg
305                 310                 315                 320

Leu Val Leu Ala His Leu Ala Arg Cys Gly Val Leu Phe Gly Gly Cys
                325                 330                 335

Thr Ser Pro Ala Leu Leu Ser Gln Gly Ser Ile Leu Leu Glu His Val
            340                 345                 350
```

```
Ala Glu Met Glu Asp Pro Ser Thr Gly Ala Ala Arg Val His Ala Ile
        355                 360                 365

Leu Gln Asp Leu Gly Leu Ser Pro Gly Ala Ser Asp Val Glu Leu Val
    370                 375                 380

Gln His Val Cys Ala Ala Val Cys Thr Arg Ala Ala Gln Leu Cys Ala
385                 390                 395                 400

Ala Ala Leu Ala Ala Val Leu Ser Cys Leu Gln His Ser Arg Glu Gln
                405                 410                 415

Gln Thr Leu Gln Val Ala Val Ala Thr Gly Gly Arg Val Cys Glu Arg
            420                 425                 430

His Pro Arg Phe Cys Ser Val Leu Gln Gly Thr Val Met Leu Leu Ala
        435                 440                 445

Pro Glu Cys Asp Val Ser Leu Ile Pro Ser Val Asp Gly Gly Gly Arg
    450                 455                 460

Gly Val Ala Met Val Thr Ala Val Ala Ala Arg Leu Ala Ala His Arg
465                 470                 475                 480

Arg Leu Leu Glu Glu Thr Leu Ala Pro Phe Arg Leu Asn His Asp Gln
                485                 490                 495

Leu Ala Ala Val Gln Ala Gln Met Arg Lys Ala Met Ala Lys Gly Leu
            500                 505                 510

Arg Gly Glu Ala Ser Ser Leu Arg Met Leu Pro Thr Phe Val Arg Ala
        515                 520                 525

Thr Pro Asp Gly Ser Glu Arg Gly Asp Phe Leu Ala Leu Asp Leu Gly
    530                 535                 540

Gly Thr Asn Phe Arg Val Leu Leu Val Arg Val Thr Thr Gly Val Gln
545                 550                 555                 560

Ile Thr Ser Glu Ile Tyr Ser Ile Pro Glu Thr Val Ala Gln Gly Ser
                565                 570                 575

Gly Gln Gln Leu Phe Asp His Ile Val Asp Cys Ile Val Asp Phe Gln
            580                 585                 590

Gln Lys Gln Gly Leu Ser Gly Gln Ser Leu Pro Leu Gly Phe Thr Phe
        595                 600                 605

Ser Phe Pro Cys Arg Gln Leu Gly Leu Asp Gln Gly Ile Leu Leu Asn
    610                 615                 620

Trp Thr Lys Gly Phe Lys Ala Ser Asp Cys Glu Gly Gln Asp Val Val
625                 630                 635                 640

Ser Leu Leu Arg Glu Ala Ile Thr Arg Arg Gln Ala Val Glu Leu Asn
                645                 650                 655

Val Val Ala Ile Val Asn Asp Thr Val Gly Thr Met Met Ser Cys Gly
            660                 665                 670
```

```
Tyr Glu Asp Pro Arg Cys Glu Ile Gly Leu Ile Val Gly Thr Gly Thr
        675                 680                 685

Asn Ala Cys Tyr Met Glu Glu Leu Arg Asn Val Ala Gly Val Pro Gly
    690                 695                 700

Asp Ser Gly Arg Met Cys Ile Asn Met Glu Trp Gly Ala Phe Gly Asp
705                 710                 715                 720

Asp Gly Ser Leu Ala Met Leu Ser Thr Arg Phe Asp Ala Ser Val Asp
                725                 730                 735

Gln Ala Ser Ile Asn Pro Gly Lys Gln Arg Phe Glu Lys Met Ile Ser
            740                 745                 750

Gly Met Tyr Leu Gly Glu Ile Val Arg His Ile Leu Leu His Leu Thr
        755                 760                 765

Ser Leu Gly Val Leu Phe Arg Gly Gln Gln Ile Gln Arg Leu Gln Thr
    770                 775                 780

Arg Asp Ile Phe Lys Thr Lys Phe Leu Ser Glu Ile Glu Ser Asp Ser
785                 790                 795                 800

Leu Ala Leu Arg Gln Val Arg Ala Ile Leu Glu Asp Leu Gly Leu Pro
                805                 810                 815

Leu Thr Ser Asp Asp Ala Leu Met Val Leu Glu Val Cys Gln Ala Val
            820                 825                 830

Ser Gln Arg Ala Ala Gln Leu Cys Gly Ala Gly Val Ala Ala Val Val
        835                 840                 845

Glu Lys Ile Arg Gly Asn Arg Gly Leu Glu Glu Leu Ala Val Ser Val
    850                 855                 860

Gly Val Asp Gly Thr Leu Tyr Lys Leu His Pro Arg Phe Ser Ser Leu
865                 870                 875                 880

Val Ala Ala Thr Val Arg Glu Leu Ala Pro Arg Cys Val Val Thr Phe
                885                 890                 895

Leu Gln Ser Glu Asp Gly Ser Gly Lys Gly Ala Ala Leu Val Thr Ala
            900                 905                 910

Val Ala Cys Arg Leu Ala Gln Leu Thr Arg Val
        915                 920


<210> 8
<211> 465
<212> PRT
<213> Homo sapiens

<220>
<223> human hexokinase IV (HK4p)

<400> 8
Met Leu Asp Asp Arg Ala Arg Met Glu Ala Ala Lys Lys Glu Lys Val
  1               5                  10                  15
```

```
Glu Gln Ile Leu Ala Glu Phe Gln Leu Gln Glu Glu Asp Leu Lys Lys
            20                  25                  30

Val Met Arg Arg Met Gln Lys Glu Met Asp Arg Gly Leu Arg Leu Glu
        35                  40                  45

Thr His Glu Glu Ala Ser Val Lys Met Leu Pro Thr Tyr Val Arg Ser
    50                  55                  60

Thr Pro Glu Gly Ser Glu Val Gly Asp Phe Leu Ser Leu Asp Leu Gly
65                  70                  75                  80

Gly Thr Asn Phe Arg Val Met Leu Val Lys Val Gly Glu Gly Glu Glu
                85                  90                  95

Gly Gln Trp Ser Val Lys Thr Lys His Gln Met Tyr Ser Ile Pro Glu
            100                 105                 110

Asp Ala Met Thr Gly Thr Ala Glu Met Leu Phe Asp Tyr Ile Ser Glu
        115                 120                 125

Cys Ile Ser Asp Phe Leu Asp Lys His Gln Met Lys His Lys Lys Leu
    130                 135                 140

Pro Leu Gly Phe Thr Phe Ser Phe Pro Val Arg His Glu Asp Ile Asp
145                 150                 155                 160

Lys Gly Ile Leu Leu Asn Trp Thr Lys Gly Phe Lys Ala Ser Gly Ala
                165                 170                 175

Glu Gly Asn Asn Val Val Gly Leu Leu Arg Asp Ala Ile Lys Arg Arg
            180                 185                 190

Gly Asp Phe Glu Met Asp Val Val Ala Met Val Asn Asp Thr Val Ala
        195                 200                 205

Thr Met Ile Ser Cys Tyr Tyr Glu Asp His Gln Cys Glu Val Gly Met
    210                 215                 220

Ile Val Gly Thr Gly Cys Asn Ala Cys Tyr Met Glu Glu Met Gln Asn
225                 230                 235                 240

Val Glu Leu Val Glu Gly Asp Glu Gly Arg Met Cys Val Asn Thr Glu
                245                 250                 255

Trp Gly Ala Phe Gly Asp Ser Gly Glu Leu Asp Glu Phe Leu Leu Glu
            260                 265                 270

Tyr Asp Arg Leu Val Asp Glu Ser Ser Ala Asn Pro Gly Gln Gln Leu
        275                 280                 285

Tyr Glu Lys Leu Ile Gly Gly Lys Tyr Met Gly Glu Leu Val Arg Leu
    290                 295                 300

Val Leu Leu Arg Leu Val Asp Glu Asn Leu Leu Phe His Gly Glu Ala
305                 310                 315                 320

Ser Glu Gln Leu Arg Thr Arg Gly Ala Phe Glu Thr Arg Phe Val Ser
                325                 330                 335
```

```
Gln Val Glu Ser Asp Thr Gly Asp Arg Lys Gln Ile Tyr Asn Ile Leu
            340                 345                 350

Ser Thr Leu Gly Leu Arg Pro Ser Thr Thr Asp Cys Asp Ile Val Arg
        355                 360                 365

Arg Ala Cys Glu Ser Val Ser Thr Arg Ala Ala His Met Cys Ser Ala
    370                 375                 380

Gly Leu Ala Gly Val Ile Asn Arg Met Arg Glu Ser Arg Ser Glu Asp
385                 390                 395                 400

Val Met Arg Ile Thr Val Gly Val Asp Gly Ser Val Tyr Lys Leu His
                405                 410                 415

Pro Ser Phe Lys Glu Arg Phe His Ala Ser Val Arg Arg Leu Thr Pro
            420                 425                 430

Ser Cys Glu Ile Thr Phe Ile Glu Ser Glu Glu Gly Ser Gly Arg Gly
        435                 440                 445

Ala Ala Leu Val Ser Ala Val Ala Cys Lys Lys Ala Cys Met Leu Gly
    450                 455                 460

Gln
465
```

<210> 9
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:hexahistidine affinity tag

<400> 9
```
His His His His His His
  1               5
```

<210> 10
<211> 200
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:poly-Gly flexible linker

<220>
<221> MOD_RES
<222> (6)..(200)
<223> Gly residues from position 6 to 200 may be present or absent

<400> 10
```
Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
  1               5                  10                  15
```

```
Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
             20                  25                  30

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
         35                  40                  45

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
     50                  55                  60

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
 65                  70                  75                  80

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
                 85                  90                  95

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
            100                 105                 110

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
        115                 120                 125

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
    130                 135                 140

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
145                 150                 155                 160

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
                165                 170                 175

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
            180                 185                 190

Gly Gly Gly Gly Gly Gly Gly Gly
        195                 200
```

<210> 11
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKI forward

<400> 11
gctggagatg gaaaatcaca ccacc 25

<210> 12
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKI reverse

<400> 12
ccccccacga gacaaacaga atg 23

<210> 13
<211> 29
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKII forward

<400> 13
gggaaggggg agtttttagt ttgttttac 29

<210> 14
<211> 28
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKII reverse

<400> 14
ccacaggcga atgaggtatt tctatgac 28

<210> 15
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKIII forward

<400> 15
ttgcggcagg gggaagaaac 20

<210> 16
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKIII reverse

<400> 16
caccacgaag tctccttgct cagtg 25

<210> 17
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKIV forward

<400> 17
ctgagtggct tgtgattctg ggatg 25

<210> 18
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKIV reverse

<400> 18
ctgcttgggg tttcttcctg agc 23

<210> 19
<211> 25
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKV forward

<400> 19
ctatggcttt cagtcttgtg gctgc 25

<210> 20
<211> 23
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific primer HKV reverse

<400> 20
agtgctccct ggcaatcaac ctc 23

<210> 21
<211> 22
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific positive control primer Human GAPDH
forward

<400> 21
gagaaggctg gggctcattt gc 22

<210> 22
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:RT-PCR
gene-specific positive control primer Human GAPDH
reverse

<400> 22
tgtcgctgtt gaagtcagag gagacc 26

<210> 23
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:quantitative
real-time PCR gene-specific primer mHK5 (sense)

<400> 23
ctgcaggaga cggtgaaaga g 21

<210> 24
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:quantitative
real-time PCR gene-specific primer mHK5
(antisense)

<400> 24
cgctgccgtc ttctgaca 18

<210> 25
<211> 22
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:endogenous
control mouse beta-actin primer (sense)

<400> 25
cgtgaaaaga tgacccagat ca 22

<210> 26
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:endogenous
control mouse beta-actin primer (antisense)

<400> 26
cacagcctgg atggctacgt 20